

A SAFETY CHECKLIST FOR THE ASSESSMENT OF IN-VEHICLE INFORMATION SYSTEMS

In-vehicle systems can potentially distract the driver and present a safety hazard.

This Checklist provides a structured aid to an expert for the assessment of the safety related features of in-vehicle information and communication systems. The technical content is based on emerging international standards and existing codes of practice, such as the European Commission's Statement of Principles on Human Machine Interface.



The checklist is part of an assessment manual that contains:

- Scenario description proforma
- Detailed assessment scoring sheets
- Assessment summary table
- Supporting technical information
- References, glossary and abbreviations

The supporting technical information explains how the checklist should be applied and provides the background and rationale to the assessment questions.

The checklist was developed by the Transport Research Laboratory for the UK Department of the Environment, Transport and the Regions. Copies of the manual can be obtained from :-

TRL library, Crowthorne Berks, RG45 6AU, UK Tel +44(0) 1344 770783, Fax +44(0) 1344 770193 Email: info@trl.co.uk

Assessment sheets can also be obtained from <http://www.trl.co.uk/pa3536.htm>

**TRANSPORT
RESEARCH
LABORATORY**



**A SAFETY CHECKLIST FOR THE
ASSESSMENT OF IN-VEHICLE INFORMATION
SYSTEMS: SCORING PROFORMA**

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A SAFETY CHECKLIST FOR THE ASSESSMENT OF IN-VEHICLE INFORMATION SYSTEMS: SCORING PROFORMA

1 INTRODUCTION

This Scoring Proforma is for use as part of the Safety Checklist developed by the Transport Research Laboratory (TRL) at the request of the United Kingdom's Department of the Environment, Transport and the Regions (DETR).. The main function of the Checklist is to provide a structured aid to allow an assessor to establish whether or not the use of an In-Vehicle Information Systems (IVIS) might compromise safety.

It should be completed only after reading the comprehensive instructions and detailed guidelines contained in the User Manual (Project Report PA3536/99) which is available from TRL's Library. While the Manual contained only one Scoring Proforma the intention was that one would be required for each assessment conducted.

There are 3 separate parts to be completed:

- Assessment Scenario (Section 2)
- In-depth assessment (Section 3), and
- Assessment Summary Report (Section 4).

The Manual also contains: Supportive Information, which provides greater explanation about the application of the Checklist, as well as allowing the assessor(s) to clarify Checklist questions and understand the rationale behind them. A list of Technical References, Abbreviations and a Glossary of Terms is provided in the Manual.

2 ASSESSMENT SCENARIO

1. IVIS under assessment

Product name and version	
Manufacturer / Supplier	
Build status (e.g. prototype, production)	
Description of HMI Subsystems (e.g. screen, hand control)	
Documentation included (e.g. driver's manual)	

2. IVIS functions excluded from assessment

Excluded functions	Reason for exclusion (e.g. not intended for use while driving)

3. Context and restrictions for intended use

Vehicle	
Driver group considered (e.g. special skill requirements)	
Road type considered (e.g. urban, motorway)	
Traffic (e.g. mix and density)	
Other environmental (e.g. weather, day/night time)	
Infrastructure requirement	

Assessors:

Date:

3 IN-DEPTH ASSESSMENT

A: Documentation

Is there any documentation provided with the system? If 'No' go to Section B, if 'Yes' continue.

Yes ☐ No ☐

A1: Compliance and compatibility with regulations, standards, and recommendations

A1.1 Is there any documentation to show that suppliers have followed published regulations, standards and recommendations?

Yes ☐ No ☐

A1.2 The documentation provides evidence of the following: -

Crash-worthiness certification.	TRUE / FALSE / NA
Compliance with ISO/BS/SAE recommendations for control locations.	TRUE / FALSE / NA
Compliance with ISO/BS/SAE recommendations for display locations.	TRUE / FALSE / NA
The use of colour conventions / compliance with standards for use of colour.	TRUE / FALSE / NA
Colours follow recognised standards for motor vehicle displays.	TRUE / FALSE / NA
Auditory outputs lie in the range of 200 to 8000 Hz.	TRUE / FALSE / NA
How the volume control affects the audibility of each frequency band.	TRUE / FALSE / NA
Graphics/representational features follow appropriate standards.	TRUE / FALSE / NA
Design for ease of use by drivers with special needs, including the elderly or disabled.	TRUE / FALSE / NA
The supplier has not made any false claims about the IVIS.	TRUE / FALSE .
NA	
Response times are sufficiently rapid for operation.	TRUE / FALSE / NA
Updating of information is sufficiently rapid for operation.	TRUE / FALSE / NA
Error messages indicate system /system infrastructure failure.	TRUE / FALSE / NA

A2: IVIS packaging, information and instructions

A2.1 Does the packaging promote inappropriate use of the IVIS?

Yes ☐ No ☐ Not Available ☐

A2.2 Does the supplier provide sufficiently clear recommendations for non-use of any of the functions whilst the user is driving?

User is advised not to access help function while the vehicle is in motion.	TRUE/FALSE/NA
User is advised not to configure IVIS features when the vehicle is in motion.	TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

A2.3 Does the supplier make it sufficiently clear that the driver retains absolute responsibility for the operation of the vehicle and compliance with traffic regulations regardless of information provided by the IVIS?

The user manual clearly states that the driver retains overall responsibility for vehicle operation.

TRUE/FALSE/NA

The user manual clearly states that the driver retains responsibility for complying with traffic regulations.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

A2.4 Does the supplier provide sufficiently clear recommendations for non-use of any freestanding equipment?

The supplier recommends non-use of freestanding equipment by the driver whilst driving.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

A2.5 Does the supplier provide sufficiently clear recommendations for maintenance of the equipment?

Maintenance procedures for the equipment are clearly prescribed.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

B: Installation and Integration

B1 Once positioned and secured are the relevant components of the IVIS stable and free from shake that would significantly increase driver workload when in use?

None ☐

Minor ☐

Serious ☐

NA ☐

B2 Is physical or visual access to other driver controls/displays free from obstruction by the IVIS or its mounting?

The IVIS does not interfere with normal leg, hand and arm movements.

TRUE/FALSE/NA

The IVIS does not obstruct the view out of the windows.

TRUE/FALSE/NA

No displays are obstructed.

TRUE/FALSE/NA

No controls are obstructed.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

B3 Is physical or visual access to the IVIS free from obstruction by other driver controls/displays?

No IVIS displays are obstructed.
No IVIS controls are obstructed.

TRUE/FALSE/NA
TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

B4 Is the IVIS free from reflections and glare under all ambient lighting conditions?

The IVIS is free from reflection / glare:
during the day

TRUE/FALSE/NA

during darkness.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

B5 Are the windscreen and windows free from reflections and/or glare caused by the display?

The windows are free from reflection / glare:
during the day

TRUE/FALSE/NA

during darkness.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

B6 Does the interaction of the IVIS with other vehicle systems compromise safety?

When a visual display is shared between IVIS functions,
conflicts will not arise between different functions.
When an auditory message is being presented, other auditory outputs
(eg the radio) will mute.

TRUE/FALSE/NA

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

C: Driver input controls

All functions of all controls should be assessed, i.e. all functions of the same control for different modes / screens.

Does the IVIS have driver input control properties? If 'Yes' continue, if 'No' go to Section D.

Yes ☐No ☐**C1 Are the IVIS controls easily reached by the user when driving?**

All controls needed when driving can be reached from the normal driving position.
 Stretching or leaning is not required.
 Awkward arm or body positions are not required.

TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**C2 Is the control layout suitable for safe operation?**

Each control can be used without inadvertently activating another control.
 The layout of the controls is conducive to them being located non-visually.

TRUE/FALSE/NA
 TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**C3 Are the designs of the controls suitable for their function?**

Push buttons / toggle switches are only used to transmit discrete information.
 TRUE/FALSE/NA

Controls do not perform more than two functions.

TRUE/FALSE/NA

Where a control has two actions, they cannot be easily confused.

TRUE/FALSE/NA

Where a control has two actions, they do not need to be carried out simultaneously.

TRUE/FALSE/NA

Rotary knobs / multi-rotational knobs / thumb wheels etc. are only used to transmit continuous information.

TRUE/FALSE/NA

Control actions are consistent with conventions adopted:
 in the rest of the vehicle

TRUE/FALSE/NA

in the national location where the IVIS is to be used.

TRUE/FALSE/NA

Control labels are consistent with conventions adopted:
 in the rest of the vehicle

TRUE/FALSE/NA

national location where the IVIS is to be used.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**C4 Is each control easily discernible by different methods in daylight and during darkness?**

The IVIS controls can be distinguished by means of:

Vision: - by labels/graphics/representational features
 - by colour
 - by shape
 - by brightness.

TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA

Feel: - by means of clearance
 TRUE/FALSE/NA

TRUE/FALSE/NA

- by means of location
 - by means of grouping
 - by means of shape
 - by means of texture
 - by motion feedback

TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA

TRUE/FALSE/NA

Hearing: - by auditory feedback.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**C5 Is colour used effectively to aid coding and layout of controls?**

Red/green combinations are avoided.

TRUE/FALSE/NA

Blue/yellow combinations are avoided.

TRUE/FALSE/NA

Colour coding does not cause problems during darkness.

TRUE/FALSE/NA

Colours used do not cause adverse visual after-effects.

TRUE/FALSE/NA

The meaning of colour coding is clear.

TRUE/FALSE/NA

Colour coding conforms to stereotypical norms.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**C6 Does the lighting of controls during darkness affect vision?**

Control lighting is adequate to identify the required control.

TRUE/FALSE/NA

Control lighting is not so bright as to distract the driver.

TRUE/FALSE/NA

Control lighting is not so bright as to cause visual after effects.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**C7 Is control operation feedback adequate and appropriate?**

Control activation is indicated by:

displacement feedback

TRUE/FALSE/NA

visual feedback

TRUE/FALSE/NA

auditory feedback.

TRUE/FALSE/NA

The user can see / hear immediately that the IVIS is responding to their input.

TRUE/FALSE/NA

The user can see / hear immediately if they have made an input error or incompatible choice.

TRUE/FALSE/NA

The IVIS responds immediately to control activation.

TRUE/FALSE/NA

The IVIS can cope with fast sequential data input.

TRUE/FALSE/NA

Visual feedback persists long enough to permit vision to the road to be maintained and the feedback not be lost.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**D: Auditory properties***Does the IVIS have auditory features? If 'Yes' continue, if 'No' go to Section E.*Yes ☐No ☐**D1 Is the volume of auditory output adjustable over a reasonable range?**

Auditory output can be adjusted to:

be heard under all driving conditions
TRUE/FALSE/NA
a level that will not startle the driver.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

D2 Where the volume of auditory output cannot be adjusted, does it present safety concerns?

Auditory output is loud enough:
to be heard under all driving conditions, but
not so loud that it may startle the driver.

TRUE/FALSE/NA

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

E: Visual properties of the display and display screen

Does the IVIS have a visual display? If 'Yes' continue if 'No' go to Section F.

Yes ☐No ☐

E1 Does information presented on the IVIS display appear legible?

Legibility is not compromised by:

size of image

TRUE/FALSE/NA

contrast

TRUE/FALSE/NA

brightness

TRUE/FALSE/NA

illumination

TRUE/FALSE/NA

image stability

TRUE/FALSE/NA

resolution

TRUE/FALSE/NA

colour.

TRUE/FALSE/NA

The use of capitals is limited, for example, to first letter only.

TRUE/FALSE/NA

Graphics/representational features are clearly the same when highlighted
or reversed out.

TRUE/FALSE/NA

Horizontal and vertical spacing of words and sentences is consistent.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

E2 Can the IVIS internal illumination be used without washout of the display in any conditions?

None ☐Minor ☐Serious ☐NA ☐

E3 Are colours used effectively in the design and presentation of visual images?

Colours are limited to clearly differentiated sets.

TRUE/FALSE/NA

Colours are equally visible under night-time viewing conditions.

TRUE/FALSE/NA

Red/green and blue/yellow colour combinations are avoided.	TRUE/FALSE/NA
Colour displays (LED and display images) are unambiguous without full colour vision.	TRUE/FALSE/NA
Problems of colours distorting the appearance of adjacent colours and colour after-effects are avoided.	TRUE/FALSE/NA
Colours conform with stereotypical norms.	TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**E4 Are the displays lit during darkness without unduly affecting vision?**

The IVIS illumination does not cause visual discomfort/distraction.	TRUE/FALSE/NA
The IVIS illumination does not prevent the displayed information from being clearly legible.	TRUE/FALSE/NA
The IVIS illumination does not cause visual after affects.	TRUE/FALSE/NA
Automatic / manual dimming controls are within an acceptable range.	TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**F: Dialogue between user and system****F1: Visual information presentation****F1.1 Is the apparent size of the display images appropriate to their function?**

Information requiring immediate action is more prominent.	TRUE/FALSE/NA
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None ☐Minor ☐Serious ☐NA ☐**F1.2 Is the use of graphics/representational features appropriate to their function?**

The choice of graphics/representational features is suitable for what they represent.	TRUE/FALSE/NA
Graphics/representational features designs are not too detailed or complex.	TRUE/FALSE/NA
Functionally related graphics/representational features have a consistent style.	TRUE/FALSE/NA
The use of text can be supported by graphics/representational features.	TRUE/FALSE/NA
The use of graphics/representational features can be supported by text.	TRUE/FALSE/NA
Graphics/representational features representing road signs are the same as actual road signs.	TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**F1.3 If graphics/representational features are used is the layout appropriate?**

Graphics/representational features are functionally grouped where possible.	TRUE/FALSE/NA
Graphics/representational features are not cluttered.	TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

F2: Auditory information presentation

F2.1 Is an auditory output appropriate for the information to be conveyed?

None ☐Minor ☐Serious ☐NA ☐

F2.2 Is the auditory information able to be repeated when necessary?

The auditory information is automatically repeated where appropriate.
 The auditory information can be repeated on request by the user.

TRUE/FALSE/NA
 TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

F2.3 If the auditory output can be turned off, does it provide feedback to the user about its status?

The user is informed when the auditory output has been turned off.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐**F3: Information comprehension***Does the IVIS use language? If 'Yes' continue, if 'No', go to section F4.*Yes ☐No ☐

F3.1 Is numerical data presented appropriately?

An analogue format is employed for fluctuating values.
 An appropriate number of decimal places are used.
 Numbering has appropriate units where required.
 A digital display is employed for relatively steady state values where the
 absolute numerical value needs to be known.

TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA
 TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

F3.2 Are abbreviations used appropriately?

Abbreviations, if present, aid the readability of the messages.

TRUE/FALSE/NA

Abbreviations are used consistently.

TRUE/FALSE/NA

Abbreviations conform to standard conventions.

TRUE/FALSE/NA

Entire sentences are never made up from abbreviations.

TRUE/FALSE/NA

Abbreviations are translated correctly for the country and language of their use.

TRUE/FALSE/NA

Abbreviations are the most appropriate method of conveying this information.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F3.3 Is the message correct and simple?

Short words are employed in preference to long ones.

TRUE/FALSE/NA

The words employed in the dialogue are simple and obvious.

TRUE/FALSE/NA

The IVIS avoids the use of long messages.

TRUE/FALSE/NA

The IVIS avoids the use of jargon when 'plain English' could be used.

TRUE/FALSE/NA

The order of wording is logical and grammatically correct.

TRUE/FALSE/NA

Message contains all necessary information.

TRUE/FALSE/NA

Each message is distinct from others.

TRUE/FALSE/NA

The meaning of the message is clear.

TRUE/FALSE/NA

Information presented by visual and auditory modalities is consistent.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F3.4 Is immediate feedback provided when an input error has been made?

None ☐

Minor ☐

Serious ☐

NA ☐

F4: Menu facilities

Does the IVIS have menus which may be used whilst driving? If 'Yes' continue, if 'No' go to Section F5.

Yes ☐

No ☐

F4.1 Is it easy to navigate through the system menus?

The user can move from menu to sub-menu easily.

TRUE/FALSE/NA

The user can move back through sub-menus easily.

TRUE/FALSE/NA

The users are allowed to move backward and correct mistakes.

TRUE/FALSE/NA

There is a cancel or escape button provided in the menu which always has the same function/s.

TRUE/FALSE/NA

Blind alleys that trap a user deep in the structure are avoided.
Menu labels are easy to understand.

TRUE/FALSE/NA
TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F4.2 Are there an appropriate number of menus, sub-menus and final options?

The number of menus and sub-menus is as few as possible.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F5: TEMPORAL INFORMATION

F5.1 Following control activation feedback, is the required information provided within an appropriate timescale?

The IVIS informs the user that it is “busy”.

TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F5.2 Is the IVIS free from “machine pacing”?

The IVIS does not make choices for the user even if there is a delay.
The speed at which the IVIS presents information does not produce
an annoyance for the user.

TRUE/FALSE/NA

The driver can defer responding to the IVIS without loss of system status.

TRUE/FALSE/NA
TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F5.3 Is information presented sufficiently in advance of a driving decision?

None ☐

Minor ☐

Serious ☐

NA ☐

F6: Safety-related aspects of information

F6.1 Is the IVIS information consistent with the road network?

The information is consistent with:
the legal status of the road system
external information on road signs
external information on VMS displays
external information on RDS broadcasts
other external information.

TRUE/FALSE/NA
TRUE/FALSE/NA
TRUE/FALSE/NA
TRUE/FALSE/NA
TRUE/FALSE/NA

None ☐

Minor ☐

Serious ☐

NA ☐

F6.2 Is the quantity of information presented at any one time excessive?

None ☐Minor ☐Serious ☐NA ☐

F6.3 While driving, does interaction with the IVIS involve a small number of keystrokes?

Parallel inputs are not required to complete any one function.
 Single uninterrupted sequential inputs (i.e. 5 or more)
 are not required to complete any one function.

TRUE/FALSE/NA

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

F6.4 Does the IVIS present excessively distracting information?

The IVIS limits the information available when moving.

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

F6.5 Is a suitable indication given, when new/updated information arrives that is directly relevant to the driver in the current driving situation?

The method of indicating new information arriving is effective.
 The method of indicating new information is appropriate to the
 message being conveyed.

TRUE/FALSE/NA

The information is up to date and relevant to the current, real-time situation.

TRUE/FALSE/NA

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

F6.6 Are the consequences of not following the IVIS instructions clear?

The systems response following non-compliance with instructions is clearly stated.
 The system provides timely up-dated advise after non-compliance with instructions.

TRUE/FALSE/NA

TRUE/FALSE/NA

None ☐Minor ☐Serious ☐NA ☐

4 ASSESSMENT SUMMARY REPORT

Device being assessed: _____

Date: _____

Assessor(s): _____

SUMMARY OF CHECKLIST ASSESSMENT

Serious Concerns / reasons (refer to specific questions if necessary)

Minor Concerns / reasons (refer to specific questions if necessary)

Overall Assessment

ADDITIONAL COMMENTS AND DESIGN RECOMMENDATIONS

Additional Comments

Recommendations

ASSESSMENT SUMMARY REPORT (continued)